



U.S. Department
of Transportation
**Federal Aviation
Administration**

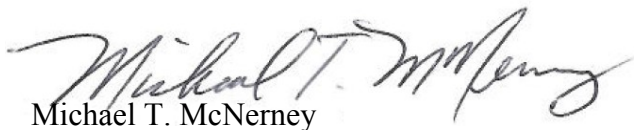
Memorandum

Subject: **INFORMATION**: Engineering Brief 67C
Light Sources Other Than Incandescent and Xenon For
Airport and Obstruction Lighting Fixtures
From: Manager, Airport Engineering Division, AAS-100
To: All Regions
Attn: Manager, Airports Division

Date: Dec 29, 2010
Reply to
Attn. of:

Engineering Brief 67C provides additional requirements for light sources other than incandescent and xenon technologies subject to certification under Advisory Circular 150/5345-53, "Airport Lighting Equipment Certification Program," and other applicable documents as required. It includes the required specific test and design requirements for alternative light sources that will be used in certified airfield lighting fixtures. This Engineering Brief ensures these new lighting technologies are seamlessly integrated with existing lighting technologies on the airfield.

Airfield Lighting Equipment Manufacturers employing alternative light sources in equipment certified under FAA Advisory Circular 150/5345-53 must meet the requirements contained in each applicable AC. The third party certification activity must verify the airfield lighting manufacturers' equipment meets the design and operational provisions as dictated by changing illuminating technology.



Michael T. McNerney

Attachment

ENGINEERING BRIEF NO. 67C

LIGHT SOURCES OTHER THAN INCANDESCENT AND XENON FOR AIRPORT AND OBSTRUCTION LIGHTING FIXTURES

I. PURPOSE

This engineering brief provides additional requirements for “Light Sources Other Than Incandescent and Xenon for Airport and Obstruction Lighting Fixtures” subject to certification under AC 150/5345-53, “Airport Lighting Equipment Certification Program,” and/or other applicable documents.

II. DESCRIPTION

This document includes specific test and design requirements for alternative light sources used in certified equipment.

III. BACKGROUND

Manufacturers utilizing alternative light sources, such as Cold Cathode, Light Emitting Diodes (LED), fiber optics, etc. in equipment certified under the U.S. Department of Transportation, Federal Aviation Administration, Advisory Circular No. 150/5345-53, must meet the requirements contained in each applicable equipment Advisory Circular. Additionally, the third party certification body must verify that the manufacturer's equipment meets the following design and operational provisions as dictated by changing illumination technology.

IV. CANCELLATION

Engineering Brief 67B, “Light Sources Other Than Incandescent and Xenon for Airport and Obstruction Lighting Fixtures, dated March 7, 2007, is canceled.

V. APPLICATION

The Airport Lighting Equipment Certification Program (ALECP) outlined in AC 150/5345-53 and listed in the addendum of that document is established for airport projects receiving Federal funds under the airport grant assistance or the passenger facility charge programs.

VI. APPLICABLE DOCUMENTS

FAA Advisory Circulars

AC 150/5340-30 Design and Installation Details for Airports Visual Aids

AC 150/5345-46 Specification for Runway and Taxiway Light Fixtures

AC 150/5345-53 Airport Lighting Equipment Certification Program

VII. PRINCIPAL CHANGES

The following principal change(s) have been incorporated:

- a. Titles are added to all paragraphs.
- b. Paragraph 2.1.1 is added to redefine aviation white chromaticity boundaries.
- c. Paragraph 2.4 is added for an alternative lighting fixture accelerated life test.
- d. Paragraph 2.5 is updated to better define requirements.
- e. Paragraph 2.5.1 is added for alternative light fixture power factor and method of determination.
- f. Paragraph 2.8 is updated to include L-860E light fixtures.
- g. Paragraph 2.12 is updated to include specific requirements for Category C2 surge protection not currently defined in the latest revision of the ANSI/IEEE C62.41.
- h. Paragraph 2.13 is updated to better define optional arctic kit requirements and include in-pavement light fixtures.
- i. Paragraph 3.1 is reworded to better define the requirement.

1.0 Intensity Ratios – The intensity of a fixture with an alternative light source intended to operate on a 3 or 5 step Constant Current Regulator must vary in accordance with characteristics of an incandescent lamp as described in AC 150/5340-30, “Design and Installation Details for Airport Visual Aids”. Light output must increase with increasing lamp current steps and decrease with decreasing lamp current steps in accordance with Table 1. The tolerance for the curve as shown below will be added to AC 150/5340-30 at a later date.

The average measured intensity may not be more than three times the specified average intensity. For fixtures with a minimum but no average intensity requirement, the measured minimum may be no more than three times the specified minimum intensity. Bi-directional, split color, fixtures are exempt from this requirement if a single light is used.

For series circuit applications, the fixture’s light intensity shall be based on a continuous curve and shall not use discrete step intensity changes.

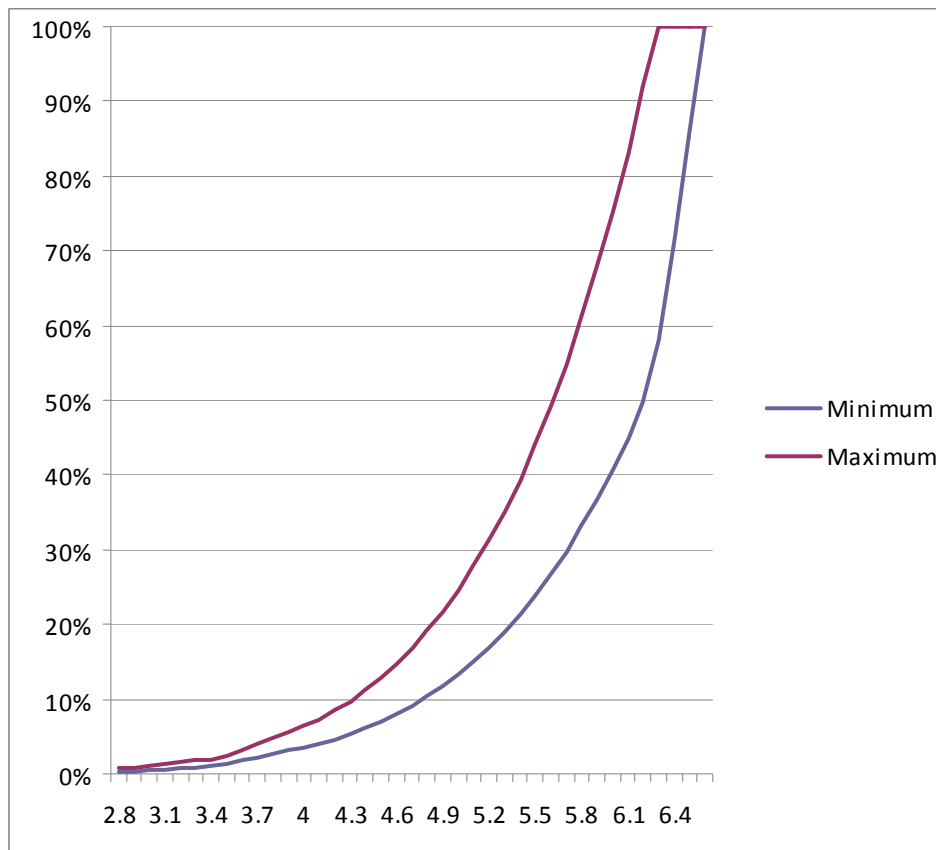


Figure 1: Dimming Curve (Applies To White Light Only)

LAMP CURRENT	% MINIMUM INTENSITY	% MAXIMUM INTENSITY
6.6	100	n/a
5.5	23.9	44.1
5.2	16.9	31.3
4.8	10.4	19.2
4.1	3.9	7.3
3.4	1.0	2.0
2.8	0.15	0.7

Table 1 (Applies To White Light Only)

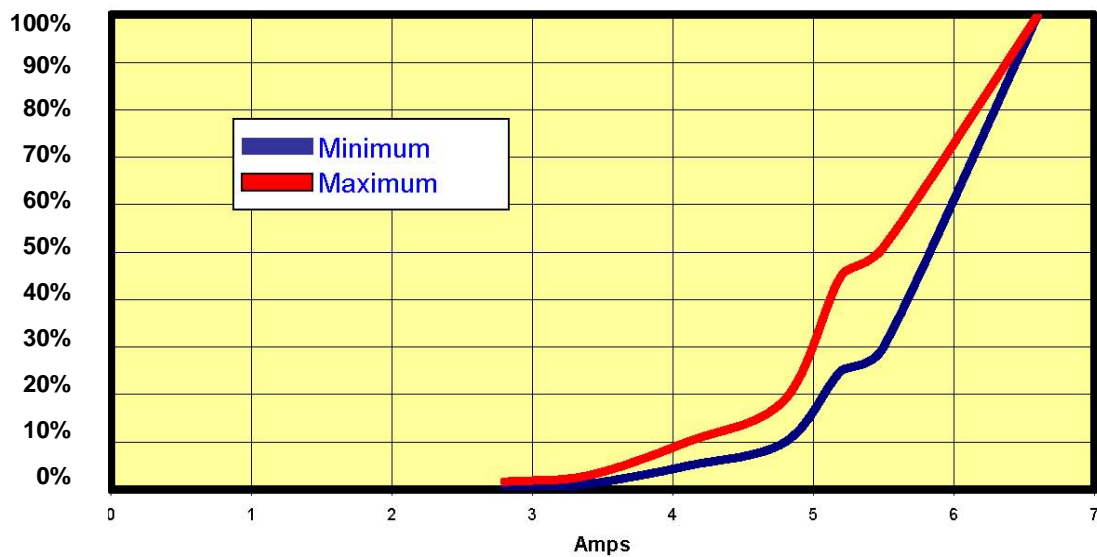


Figure 2 (Applies To Colored Light Only)

LAMP CURRENT	% MINIMUM INTENSITY	% MAXIMUM INTENSITY
6.6	100	n/a
5.5	30.0	51.0
5.2	25.0	45.0
4.8	10.0	19.0
4.1	5.0	10.0
3.4	1.2	3.0
2.8	0.15	1.65

Table 2 (Applies To Colored Light Only)

2.0 Additional Qualification Requirements/Testing

2.1 Chromaticity – All fixtures must meet the chromaticity requirements of each applicable Advisory Circular for color of light emitted. Testing must be done using a spectroradiometer in increments of 2nm or less. Testing must be conducted after a 15-minute operation in ambient conditions at +25°C.

2.1.1 Aviation White Chromaticity Boundaries – All fixtures must meet the following chromaticity boundaries for aviation white:

- Yellow boundary: $x = 0.440$
- Blue boundary: $x = 0.320$
- Green boundary: $y = 0.150 + 0.643x$
- Purple boundary: $y = 0.050 + 0.757x$

2.1.2 Dominant Wavelengths – Fixtures emitting a green color must meet the following dominant wavelengths for colors as specified below:

- Green: 520 to 534 nanometers (nm)

2.2 High Temperature Test – Unless specified in other Advisory Circulars, alternative light source fixtures must meet the following requirements. Manufacturers must ensure that the light output of the fixture does not drop more than 30% of the photometric requirement of the applicable AC when operated at high temperature. The photometric measurement must be done after 15 minutes of operation (for products covered under FAA AC 150/5345-46) or stabilization (for all other products) at 25C, and again after 4 hours of continuous operation at 55C.

2.3 Fixtures must be designed to operate and interface with all existing airport lighting equipment systems contained in FAA Advisory Circular 150/5345-53.

2.4 Accelerated Life Test - Alternative light sources must be subjected to the accelerated life test per AC 150/5345-53C, *AIRPORT LIGHTING EQUIPMENT CERTIFICATION PROGRAM*, with the following exception and addition:

- a. The accelerated life test duration shall be 500 hours at 131 degrees Fahrenheit (55 degrees Celsius). A light system shall be operated at highest fixture manufacturer rated voltage or current using approved regulators or a current supply having one percent regulation. The duty cycle shall consist of 20 hours fixture operating time and 4 hours de-energized. A voltage controlled system shall be operated from a supply having three percent regulation. This test may be run in parallel with other accelerated life tests.
- b. The manufacturer must report to the 3rd party certifier that the junction temperature of the LED fixture was tested. This will determine if the measured junction temperature exceeded the LED manufacturers' maximum junction temperature.

2.5 Light Fixture Performance Criteria - Manufacturers are required to publish the performance criteria for all light generating devices. This performance criteria is defined as worst-case

wattage and VA at both the input leads of the fixture and, for fixtures powered from a series circuit, across the primary winding of an appropriately sized isolation transformer. The fixture lead length shall not exceed 24 inches for this test. This information shall be listed on the manufacturer's datasheets and verified by third party certification body. The manufacturer shall also state the operational current range, for series circuit powered fixtures, or input voltage range, for voltage powered fixtures, on their datasheets and verified by the third party certification body test laboratory.

2.5.1 Light Fixture Power Factor - The true power factor for all fixtures powered by a Constant Current Regulator must not be less than 0.7 when measured at the input power leads of the fixture on all constant current regulator current steps. The true power factor measurement must be done over the frequency range of 0 to 150 kHz. The power factor measurement must not be displacement power factor ($\cos \phi$). Test will be conducted using a sine wave source.

2.6 Fixtures Using Multiple Light Devices - If multiple light devices to produce a single source are used, the design must ensure the fixture meets the light output specification while it is on, and it must discontinue operation if at least 25% of the light devices fail. Additionally, all light devices must randomly connected to ensure that there will be no axial failures in the horizontal or vertical.

2.7 Fixture Monitoring - Fixtures that have the capability to be electronically monitored must provide that capability at the top two intensity steps on a 3-step constant current regulator and the top three intensity steps on a 5-step constant current regulator. The fixture in any failure condition (other than photometric) must have the ability to provide an open circuit (fail-open) at the secondary of the isolation transformer, or draw zero current on a constant voltage circuit. Other appropriate monitoring methods may be used if the fixtures can retrofit into existing monitoring systems.

2.8 Fixture Daytime Viewing - Means must be provided on all L-860E, L-861T, L-861E, L-861SE and L-862E elevated airport to indicate specified light color during daytime viewing. The minimum colored surface area must be a minimum of 2 1/2 sq. in. from any direction when using a horizontal viewing angle of 0° to +45°. The color must comply with the aviation colors as defined in the Society of Automotive Engineers (SAE) AS-25050, "Colors, Aeronautical Lights and Lighting Equipment, General Requirements for", specification corresponding to the fixture energized color and may be accomplished with appropriate means such as reflective material (not retro-reflective), painting, or coloring of the fixture components. The upper portion of the fixture body may also be painted to achieve the desired amount of colored surface area. For surfaces below the optical or daytime visibility area surface on elevated lights, the exterior finish must match color No. 13538, Aviation Yellow, Table V of FED-STD-595B unless otherwise specified. The finish of a fixture heat sink or cooling element may be a natural finish or black.

2.9 Flashing Lights - Flashing lights with alternate lighting sources subject to certification under AC 150/5345-53 and/or other applicable documents must have all testing conducted in the flashing mode.

2.10 Detector Calibration - To verify proper color correction, photometric testing conducted on alternate light source fixtures must be done with a detector having an up to date calibration including spectral response data.

2.11 Electromagnetic Emissions - The alternate light source fixture and associated on-board circuitry must meet Federal Communications Commission (FCC) Title 47, Subpart B, Section 15, “Unintentional Radiators”, regulations concerning the emission of electronic noise. Both conducted and radiated emission limits must be tested.

2.12 Surge Protection - The interface circuitry (if any) and solid state devices shall be designed to withstand and/or include separate surge protection devices which have been tested against defined waveforms detailed in Table 4, Location Category C2 of ANSI/IEEE C62.41-1991 “Recommended Practice on Surge Voltages in Low Voltage AC Power Circuits”, Standard 1.2/50 microsecond (μ S) – 8/20 μ S Combination Wave. Peak voltage is 10 kilovolts, peak current is 5 kilo amps with a nominal ratio of peak open circuit voltage to peak short circuit current of 2 ohms. Obstruction Lights per FAA Advisory Circular 150/5345-43, “Specification for Obstruction Lighting Equipment” are excluded from this requirement.

2.13 Optional Arctic Kits - Any fixture (includes in-pavement fixtures), with the exception of obstruction lights described in FAA Advisory Circular 150/5345-43, *Specification for Obstruction Lighting Equipment*, may have an optional arctic kit and/or an appropriate addressing of potential icing conditions to no less extent than present fixtures. An arctic kit may be an optional feature and may be specified by the customer at the time of purchase. The arctic kit, if present, must be self-activating.

2.13.1 Arctic Kit Testing Requirements. The arctic kit must be tested as follows:

- a. With light source and arctic kit off, the light fixture must be stabilized for 4 hours at -20°C.
- b. Then, in still air and with the light source activated at the highest intensity setting, the main beam light emitting surface temperature must rise a minimum of 15°C after 30 minutes operation.
- c. For elevated fixtures, this test is run in open-air conditions.

2.14 In-pavement Light Fixture Testing - All light fixtures with alternative light source electronics at or below grade level must be subjected to the in-pavement light tests described in FAA Advisory Circular 150/5345-46, “*Specification for Runway and Taxiway Light Fixtures*”.

3.0 Additional Production Testing

3.1 Burn-In Production Test – Alternative light sources must be energized for a minimum of 4 hours, at 100 percent intensity at standard ambient temperature before shipment. Any failure of an alternative light source during burn-in or testing after burn-in will be cause for rejection.